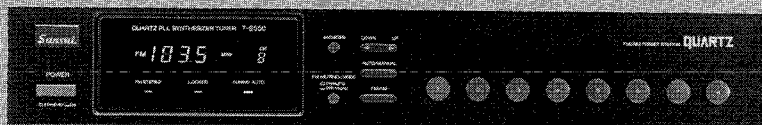


# SERVICE MANUAL

QUARTZ PLL SYNTHESIZER TUNER

## SANSUI T-E550/E550L



### CAUTION

1. Parts identified by the  $\triangle$  symbol on the schematic diagram and the parts list are critical for safety. Use only replacement parts that have critical characteristics recommended by the manufacturer.
2. Make leakage-current or resistance measurements to determine that exposed parts are acceptably insulated from the supply circuit before returning the appliance to the customer.

### •SPECIFICATIONS

#### FM Section

Tuning range..... 88 to 108 MHz  
Usable sensitivity  
Mono IHF..... 10.8 dBf (1.9  $\mu$ V : T100)  
DIN..... 0.9  $\mu$ V

#### 50 dB quieting sensitivity

Mono..... 16.5 dBf  
Stereo..... 37.0 dBf

#### Signal to noise ratio at 65 dBf

Mono..... 75 dB  
Stereo..... 70 dB

#### Distortion at 65 dBf

Mono..... less than 0.2% at 1,000 Hz  
Stereo..... less than 0.25% at 1,000 Hz

#### Alternate channel selectivity (at 400 kHz)

55 dB

#### Stereo separation..... 40 dB at 1,000 Hz

Frequency response..... 30 to 15,000 Hz  
+1.0 dB, -1.5 dB

#### Antenna input impedance

..... (300 ohms balanced)  
75 ohms unbalanced

#### AM (MW) Section

Tuning range..... 530 to 1,600 kHz  
Usable sensitivity..... 52 dB/m (398  $\mu$ V/m)  
Signal to noise ratio..... 45 dB  
Image response ratio..... 40 dB at 1,000 kHz

#### T-E550L

#### LW Section

Tuning range..... 153 to 281 kHz  
Usable sensitivity..... 62 dB/m  
Signal to noise ratio..... 45 dB  
Image response ratio..... 35 dB at 220 kHz

#### Others

##### Output voltage and impedance

..... 600 mV/2.2 kohms

##### Power requirements..... 120/220/240V

50/60 Hz

For U.S.A. and Canada

..... 120V (60 Hz)

##### Power consumption..... 8 Watts

##### Dimensions..... 380 mm (15")W

68 mm (2-11/16")H

227 mm (8-15/16")D

##### Weight..... 2.0 kg (4.4 lbs) net

2.8 kg (6.2 lbs) packed

\* Design and specifications subject to changes without notice for improvements.

\* Due to local laws and regulations, this unit sold in some areas are not equipped with variable voltage selectors

**Sansui**

SANSUI ELECTRIC CO., LTD.

## CAUTION

1. The symbols, UL, CSA, SA, BS, UK, EU, AS and XX on the parts list and the schematic diagram mean followings respectively.

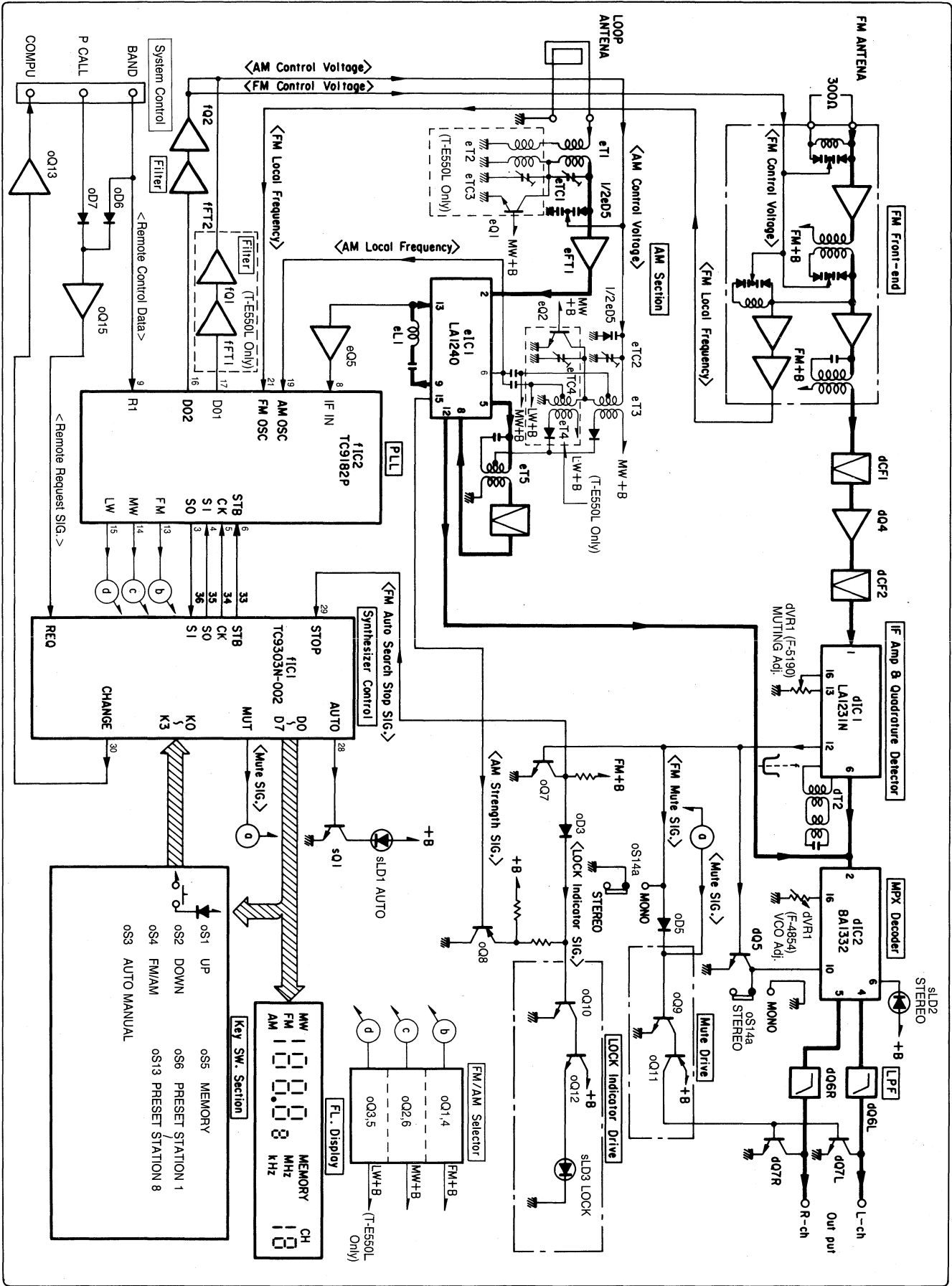
UL..... Manufactured for U.S.A market.  
 (Underwriters Laboratories approved model.)  
 CSA..... Manufactured for Canadian market.  
 SA..... Manufactured for South African market.  
 BS, UK ..... Manufactured for United Kingdom market.  
 EU ..... Manufactured for European market.  
 AS..... Manufactured for Australian market.  
 XX..... Standard Version.  
 NON MARK ..... Common Parts.

2. Some printed circuit boards are not supplied as the assembled.  
 To separate these in this service manual, the stock No's are not indicated at the ends of the board names. However, the individual parts on the circuit boards are provided by orders.
3. Since some of capacitors and resistors are omitted from parts lists in this service manual, refer to the Common Parts List for capacitors & resistors, which was issued on February 1983.
4. Abbreviations in this service manual are as follows.

### •Abbreviations List

C.R. : Carbon Resistor	E.B.L. : Low Leak Bi-Polar
S.R. : Solid Resistor	Electrolytic Capacitor
Ce.R. : Cement Resistor	Ta.C. : Tantalum Capacitor
M.R. : Metal Film Resistor	F.C. : Film Capacitor
F.R. : Fusing Resistor	M.P. : Metalized Paper Capacitor
N.I.R. : Non-Inflammable Resistor	P.C. : Polystyrene Capacitor
A.R. : Array Resistor	G.C. : Gimmic Capacitor
C.C. : Ceramic Capacitor	A.C. : Array Capacitor
C.T. : Ceramic Capacitor,	V.R. : Variable Resistor
Temperature Compensation	S.V.R. : Semi Variable Resistor
E.C. : Electrolytic Capacitor	SW. : Switch
E.L. : Low Leak Electrolytic	Chip R. : Chip Resistor
Capacitor	Chip C. : Chip Capacitor
E.B. : Bi-Polar Electrolytic	
Capacitor	

## 1. BLOCK DIAGRAM



## 2. ADJUSTMENTS

### 2-1. FM Adjustment (See Fig. 2-6, 2-7, 2-9)

Fig. 2-1

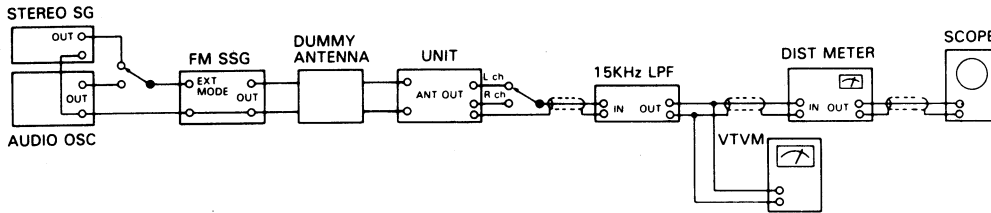
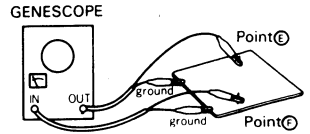


Fig. 2-2



#### 1) FM IF & Reference Frequency Adjustment

Note: 1. SELECTOR ..... FM  
2. FM MUTING/MODE ..... OFF/MONO

STEP	SUBJECT	FEED SIGNAL		MEASURE OUTPUT	ADJUST	ADJUST FOR	REMARKS
		FROM	TO				
1.	IF Coil Adj.	98MHz ANT Input 20dBf (14.8dB), 1kHz (100% MOD.), FM SSG	ANT terminal 300Ω	Between Point ⑥ (Pin 13 of d1C1) & Earth (F-4853) DC Volt Meter	IFT Coil (Front-end, F-5190)	Max. DC Volt	
2.	Discriminator Coil Adj. In case of using Genescope	Output 80dB, Genescope	Point ⑤ (dCF1)	Between Point ⑤ (Pin 6 of d1C1) & Earth (F-4853)	dT2 (F-4853)	Steep linearity of S curve. Make symmetrical S curve.	
	Discriminator Coil Adj. In case of using Dist meter	1 98MHz ANT Input 65dBf (59.8dB), No MOD., FM SSG.	ANT terminal 300Ω	Between Point ③ (Pin 7 of d1C1) & Point ④ (Pin 10 of d1C1) (F-4853) DC Volt Meter	dT2 (F-4853)	DC 0V ± 30mV	
		2 98MHz ANT Input 65dBf (59.8dB), 1kHz (100% MOD.), FM SSG	ANT terminal 300Ω	•LINE OUT L-CH or R-CH Dist Meter & SCOPE		Confirm Distortion 0.3% or below	

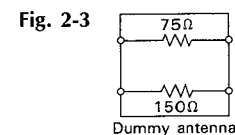
#### 2) FM STEREO Adjustment

1. FM MODE ..... AUTO

STEP	SUBJECT	FEED SIGNAL		MEASURE OUTPUT	ADJUST	ADJUST FOR	REMARKS
		FROM	TO				
1.	PLL VCO Adj.	98MHz ANT Input 65dBf (59.8dB), FM SSG, Pilot 19kHz (9% MOD.), R or L MODE 1kHz + Pilot (100% MOD.), STEREO SG	ANT terminal 300Ω	Stereo Indicator	dVR1 (F-4854)	Light indicator	•Adjust the dVR1 within center of light level
	PLL VCO Adj. In case of using Freq.	98MHz ANT Input 65dBf (59.8dB), FM SSG, No MOD.	Same as above	Between Point ③ (Pin 12 of d1C2) & Earth (F-4854) Freq. Counter	dVR1 (F-4854)	19kHz ± 25Hz	
2.	Muting level Adj.	98MHz ANT Input 25dBf (19.8dB), FM SSG, Pilot 19kHz (9% MOD.), L or R MODE 1kHz + Pilot (100% MOD.), STEREO SG.	Same as above	Stereo indicator LINE OUT L-CH or R-CH VTVM & SCOPE	dVR1 (F-5190)	Stereo indicator turns ON or Output Signal comes out	

# •ADJUSTMENT FOR FM

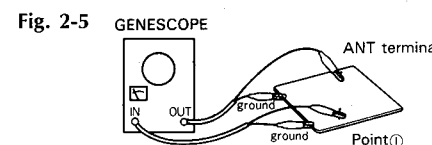
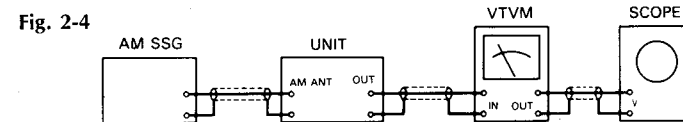
There are two kind in indication of FM SSG output attenuator  
 1. Attenuator with marking of 75Ω open ..... open indication type.  
 2. Attenuator with marking of 75Ω load or close ..... load or close indication type.  
 FM SG output level in this FM adjustment are described as open indication type.  
 To feed FM signal, a dummy antenna circuit as Fig. 2-3 must be connected between FM SG output and ANT terminal (300Ω) of the unit.



The following table shows relations among FM SG attenuator indication (dB), available power ratio (dBf) and antenna terminal voltage (dB/μV) in each indication type.

	FM SG Attenuator Indication	Available Power Ratio	Antenna Terminal Voltage
Open indication type	0 dB	-0.8 dBf	-6 dB/μV
	66 dB	65.2 dBf	60 dB/μV
Load or close indication type	0 dB	5.2 dBf	0 dB/μV
	60 dB	65.2 dBf	60 dB/μV

## 2-2. AM Adjustment (See Fig. 2-6, 2-8)



### 1) AM IF Adjustment & MW (AM) Tuning Adjustment

Note: 1. SELECTOR ..... AM or MW  
 2. Connect AM loop antenna to AM antenna terminal.

STEP	SUBJECT	FEED SIGNAL		MEASURE OUTPUT	ADJUST	ADJUST FOR	REMARKS
		FROM	TO				
1.	IF Coil Adj.	Genescope Output 60dB	ANT terminal	Between Point① (Pin 12 of eIC1) & Earth (F-4847)	eT5, eL1 (F-4847)	Max. Waveform	•Repeat procedures as stated in subject 2 & 3.
2.	522kHz (or 520kHz) Tuning Adj.	No Input	—	Between Point① (eR1) & Earth (F-5190) DC Volt Meter	eT3 (F-5190)	1V ± 0.1V	
3.	1602kHz (or 1610kHz) Tuning Adj.	No Input	—	Same as above	eTC2 (F-5190)	8V ± 0.1V	
4.	603kHz (or 600kHz) RF Adj.	603kHz (or 600kHz) ANT Input 30dB 400Hz (30% MOD.), AM SSG	ANT terminal	LINE OUT L-CH or R-CH VTVM & SCOPE	eT1 (F-5190)	Max. Output	
5.	1404kHz (or 1400kHz) RF Adj.	1404kHz (or 1400kHz) ANT Input 30dB 400Hz (30% MOD.), AM SSG	Same as above	LINE OUT L-CH or R-CH VTVM & SCOPE	eTC1 (F-5190)	Max. Output	

### 2) LW Tuning Adjustment (T-E550L only) (See Fig. 2-6)

Note: SELECTOR ..... LW

STEP	SUBJECT	FEED SIGNAL		MEASURE OUTPUT	ADJUST	ADJUST FOR	REMARKS
		FROM	TO				
1.	153kHz Tuning Adj.	No Input	—	Between Point① (eR1) & Earth DC Volt Meter	eT2 (F-5190)	1V ± 0.1V	•Repeat procedures as stated in subject 1 & 2.
2.	281kHz Tuning Adj.	No Input	—	Same as above	eTC3 (F-5190)	8V ± 0.1V	
3.	170kHz RF Adj.	170kHz ANT Input 30dB 400Hz (30% MOD.), AM SSG	ANT terminal	LINE OUT L-CH or R-CH VTVM & SCOPE	eT4 (F-5190)	Max. Output	
4.	260kHz RF Adj.	260kHz ANT Input 30dB 400Hz (30% MOD.), AM SSG	Same as above	LINE OUT L-CH or R-CH VTVM & SCOPE	eTC4 (F-5190)	Max. Output	

Fig. 2-6 F-5190 PLL Synthesizer Board

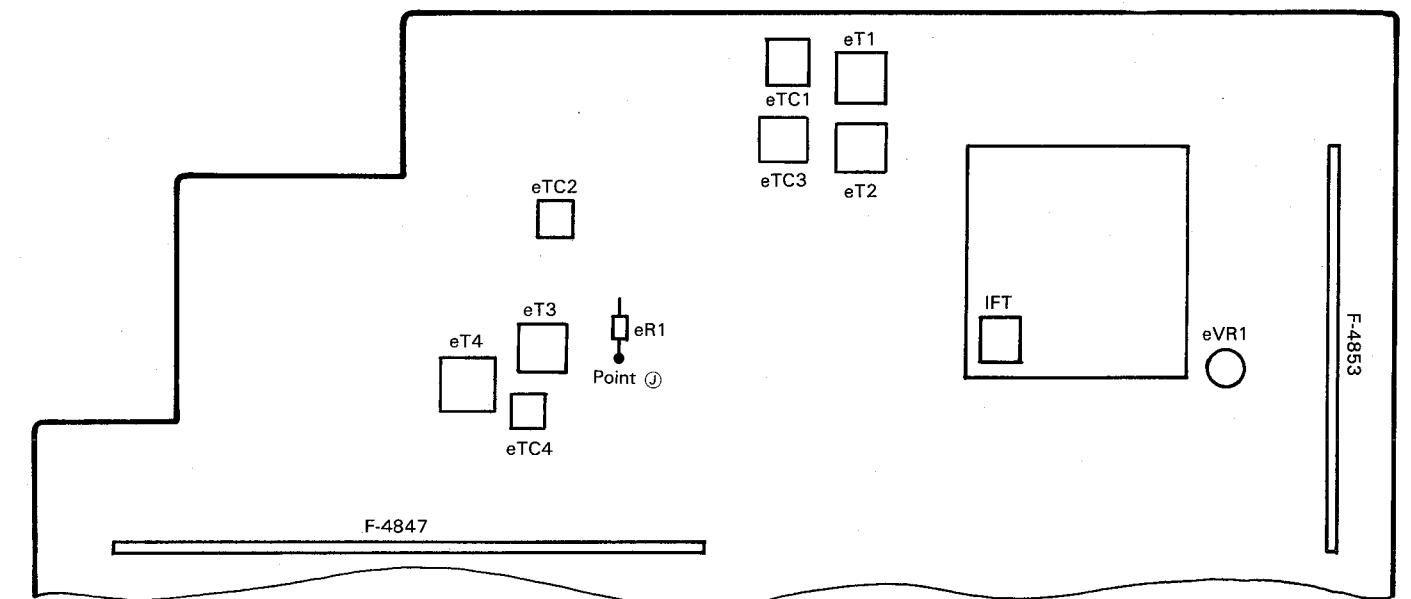


Fig. 2-7 F-4853 FM IF Amp. Board

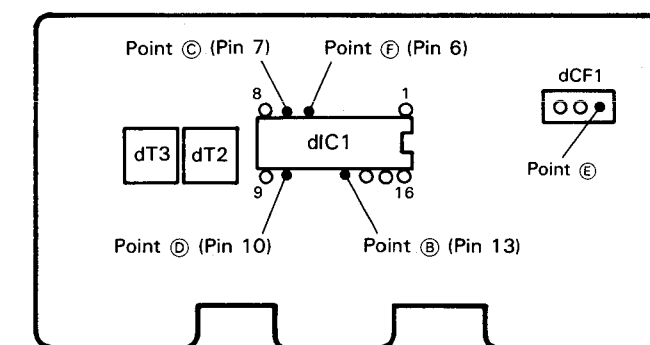


Fig. 2-9 F-4854 FM MPX Board

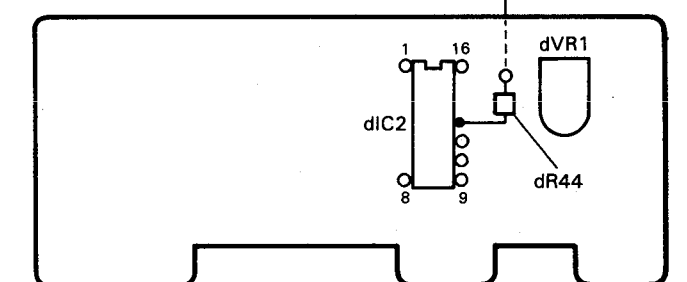
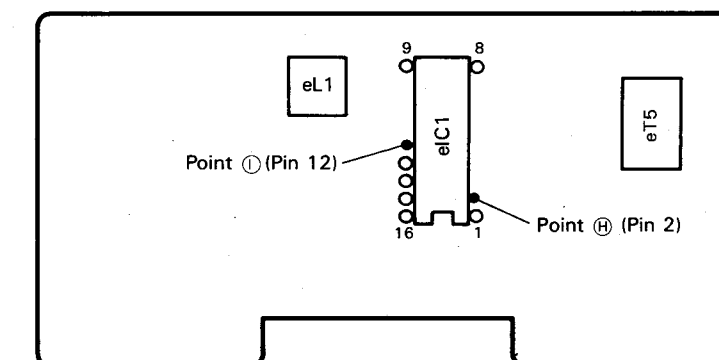


Fig. 2-8 F-4847 AM IF Amp. Board



### •Abbreviations

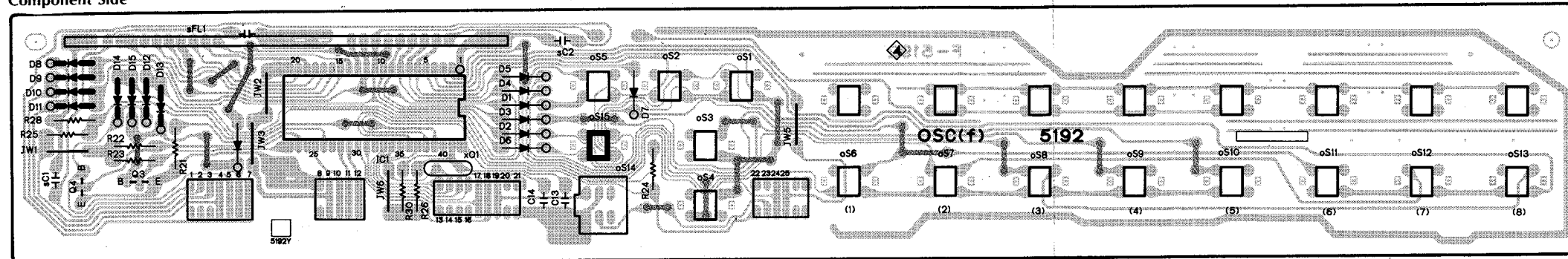
Equipment	
AM FM Generator Oscilloscope.....	Genescope
AM Standard Signal Generator.....	AM SSG
FM Standard Signal Generator.....	FM SSG
FM Stereo Generator.....	Stereo SG
Oscilloscope.....	Scope
Audio Oscillator.....	Audio Osc.
Distortion Meter.....	Dist. Meter
Others	
Antenna.....	ANT.
Modulation.....	MOD.
Total Harmonic Distortion.....	T.H.D.



### 3. PARTS LOCATION & PARTS LIST

**3-1. F-5192 PLL Synthesizer Control Board** (Stock No. 00954501 = T-E550-XX) (Stock No. 00954502 = T-E550-UL) (Stock No. 00954503 = T-E550-CSA) (Stock No. 00954504 = T-E550-SA)  
(Stock No. 00954507 = T-E550-AS) (Stock No. 00954505 = T-E550L)

Component Side

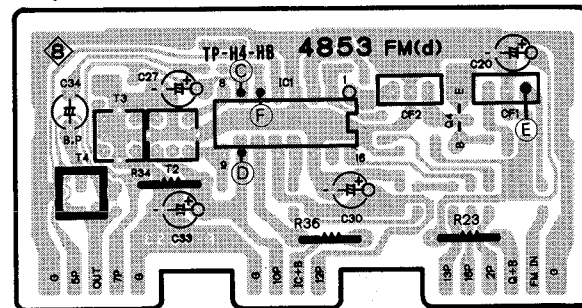


#### Parts List

Parts No.	Stock No.	Description
•Transistor		
fQ3	46719900	DTC124ES
fQ4	46719900	DTC124ES
•IC		
fIC1	48367800	TC9303AN-002
fxO1	48319600	Quartz Crystal HC-49/U
•Diode		
fD1	03117600	1S2473T77
	or 46086000	1S1588TP-3
fD2	03117600	1S2473T77
	or 46086000	1S1588TP-3
fD3	03117600	1S2473T77
	or 46086000	1S1588TP-3
fD4	03117600	1S2473T77
	or 46086000	1S1588TP-3
fD5	03117600	1S2473T77
	or 46086000	1S1588TP-3
fD6	03117600	1S2473T77
	or 46086000	1S1588TP-3
fD7	03117600	1S2473T77
	or 46086000	1S1588TP-3
fD8	03117600	1S2473T77
	or 46086000	1S1588TP-3
	07176400	1S2473HS (T-E550-SA)
fD9	03117600	1S2473T77 (T-E550-SA)
	or 46086000	1S1588TP-3 (T-E550-SA)
fD10	03117600	1S2473T77 (T-E550-XX,SA)
	or 46086000	1S1588TP-3 (T-E550-XX,SA)
fD11	03117600	1S2473T77
	or 46086000	1S1588TP-3 (T-E550-SA,AS, T-E550L)
	or 46086000	1S1588TP-3 (T-E550-SA,AS, T-E550L)
fD12	03117600	1S2473T77 (T-E550L)
	or 46086000	1S1588TP-3 (T-E550L)
oS1	46708100	Push SW., UP
oS2	46708100	Push SW., DOWN
oS3	46708100	Push SW., AUTO/MANUAL
oS4	46708100	Push SW., FM/MW
oS5	46708100	Push SW., MEMORY
oS6	46708100	Push SW., M1
oS7	46708100	Push SW., M2
oS8	46708100	Push SW., M3
oS9	46708100	Push SW., M4
oS10	46708100	Push SW., M5
oS11	46708100	Push SW., M6
oS12	46708100	Push SW., M7
oS13	46708100	Push SW., M8
oS14	48313800	Push SW., FM MUTING/MODE
sFL1	48314300	FL. Display Tube FG78M1AGR

#### 3-2. F-4853 FM IF Amp. Board (Stock No. 00954701)

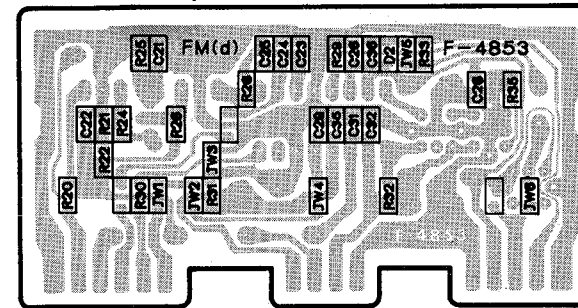
Component Side



#### Parts List

Parts No.	Stock No.	Description
•Transistor		
dQ4	46393201	2SC2786
•IC		
dIC1	07191200	LA1231N
•Diode		
dD2	46852000	RLS-73 (Chip)
dJW1	46741100	Cross Conductor (Chip)
dJW2	46741100	Cross Conductor (Chip)
dJW3	46741100	Cross Conductor (Chip)
dJW4	46741100	Cross Conductor (Chip)
dJW5	46741100	Cross Conductor (Chip)
dJW6	46741100	Cross Conductor (Chip)
dJW7	46741100	Cross Conductor (Chip)
dJW8	46741100	Cross Conductor (Chip)
dR20	46745800	180Ω 1/8W Chip R.
dR21	46747000	560Ω 1/8W Chip R.
dR22	46747600	1kΩ 1/8W Chip R.
dR23	46228700	56Ω 1/2W N.I.R.
dR24	46745200	100Ω 1/8W Chip R.
dR25	46747400	820Ω 1/8W Chip R.
dR26	46746600	390Ω 1/8W Chip R.
dR28	46746400	330Ω 1/8W Chip R.
dR29	46752400	100kΩ 1/8W Chip R.

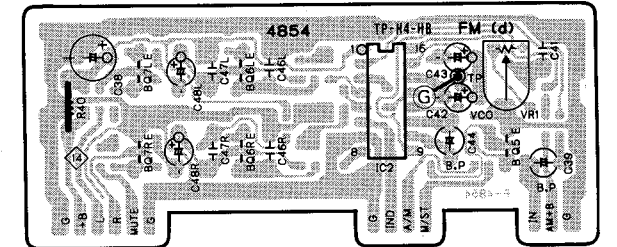
Pattern Side < Chip Parts >



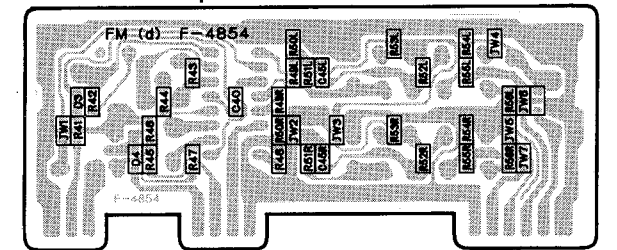
Parts No.	Stock No.	Description
dR30	46750000	10kΩ 1/8W Chip R.
dR31	46751000	27kΩ 1/8W Chip R.
dR32	46749400	5.6kΩ 1/8W Chip R.
dR33	46752400	100kΩ 1/8W Chip R.
dR34	46750800	22kΩ 1/8W Chip R.
dR36	46228700	56Ω 1/2W N.I.R.
dR37	46750600	18kΩ 1/8W Chip R.
dC21	46854500	22000pF 50V Chip C.
dC22	46854900	47000pF 50V Chip C.
dC23	46854900	47000pF 50V Chip C.
dC24	46854900	47000pF 50V Chip C.
dC25	46854900	47000pF 50V Chip C.
dC26	46778100	100pF 50V Chip C.
dC28	46854500	22000pF 50V Chip C.
dC29	46854500	22000pF 50V Chip C.
dC31	46854900	47000pF 50V Chip C.
dC32	46854900	47000pF 50V Chip C.
dC34	48102400	4.7μF 25V E.B.
dC35	46854500	22000pF 50V Chip C.
dCF1	46202500	Ceramic Filter SFE10.7MS2(RED)
	or 46202501	Ceramic Filter KBF10.7MU-NAG
dCF2	46202500	Ceramic Filter SFE10.7MS2(RED)
	or 46202501	Ceramic Filter KBF10.7MU-NAG
dT2	48415900	FM IF Coil

#### 3-3. F-4854 FM MPX Board (Stock No. 00879701)

Component Side



Pattern Side < Chip Parts >

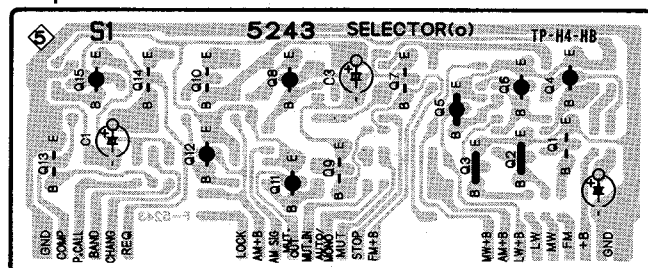


#### Parts List

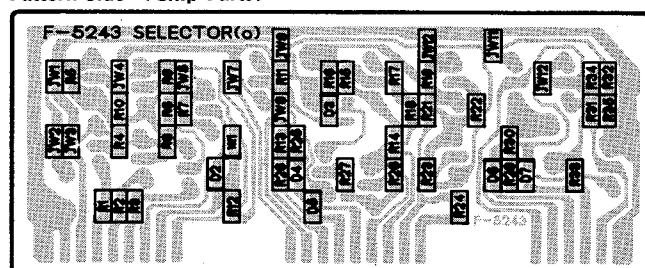
Parts No.	Stock No.	Description
•Transistor		
dQ5	46367101	2SC2603
	or 46367301	2SC2458
	or 46391901	2SC2785
dQ6	46367101	2SC2603
	or 46367301	2SC2458
	or 46391901	2SC2785
dQ7	46540801	2SC2878
	or 46604301	2SC3327
•IC		
dIC2	48169300	BA1332-SD
•Diode		
dD3	46852000	RLS-73 (Chip)
dD4	46852000	RLS-73 (Chip)
dJW1	46741100	Cross Conductor (Chip)
dR40	46681700	22Ω 1/4W F.R.
dR41	46751200	33kΩ 1/8W Chip R.
dR42	46750000	10kΩ 1/8W Chip R.
dR43	46747600	1kΩ 1/8W Chip R.
dR44	46750000	10kΩ 1/8W Chip R.
dR45	46750000	10kΩ 1/8W Chip R.
dR46	46750200	12kΩ 1/8W Chip R.
dR47	46751600	47kΩ 1/8W Chip R.
dR48	46747400	820Ω 1/8W Chip R.
dR49	46749200	4.7kΩ 1/8W Chip R.
dR50	46748800	3.3kΩ 1/8W Chip R.
dR51	46747600	1kΩ 1/8W Chip R.
dR52	46747200	680Ω 1/8W Chip R.
dR53	46745400	120Ω 1/8W Chip R.
dR54	46752000	68kΩ 1/8W Chip R.
dR55	46747800	1.2kΩ 1/8W Chip R.
dR56	46748800	3.3kΩ 1/8W Chip R.
dC39	48102400	4.7μF 25V E.B.
dC40	46854900	47000pF 50V Chip C.
dC44	48103400	1μF 50V E.B.
dC45	46778300	120pF 50V Chip C.
dC46	46283100	0.015μF 50V F.C.
dC47	46282800	8200pF 50V F.C.
dVR1	07241200	5kΩ (B) S.V.R., VCO Adj.

### 3-4. F-5243 AM/FM Band Selector Board (Stock No. 00954601 = T-E550) (Stock No. 00954605 = T-E550L)

Component Side



Pattern Side &lt; Chip Parts &gt;



Parts List

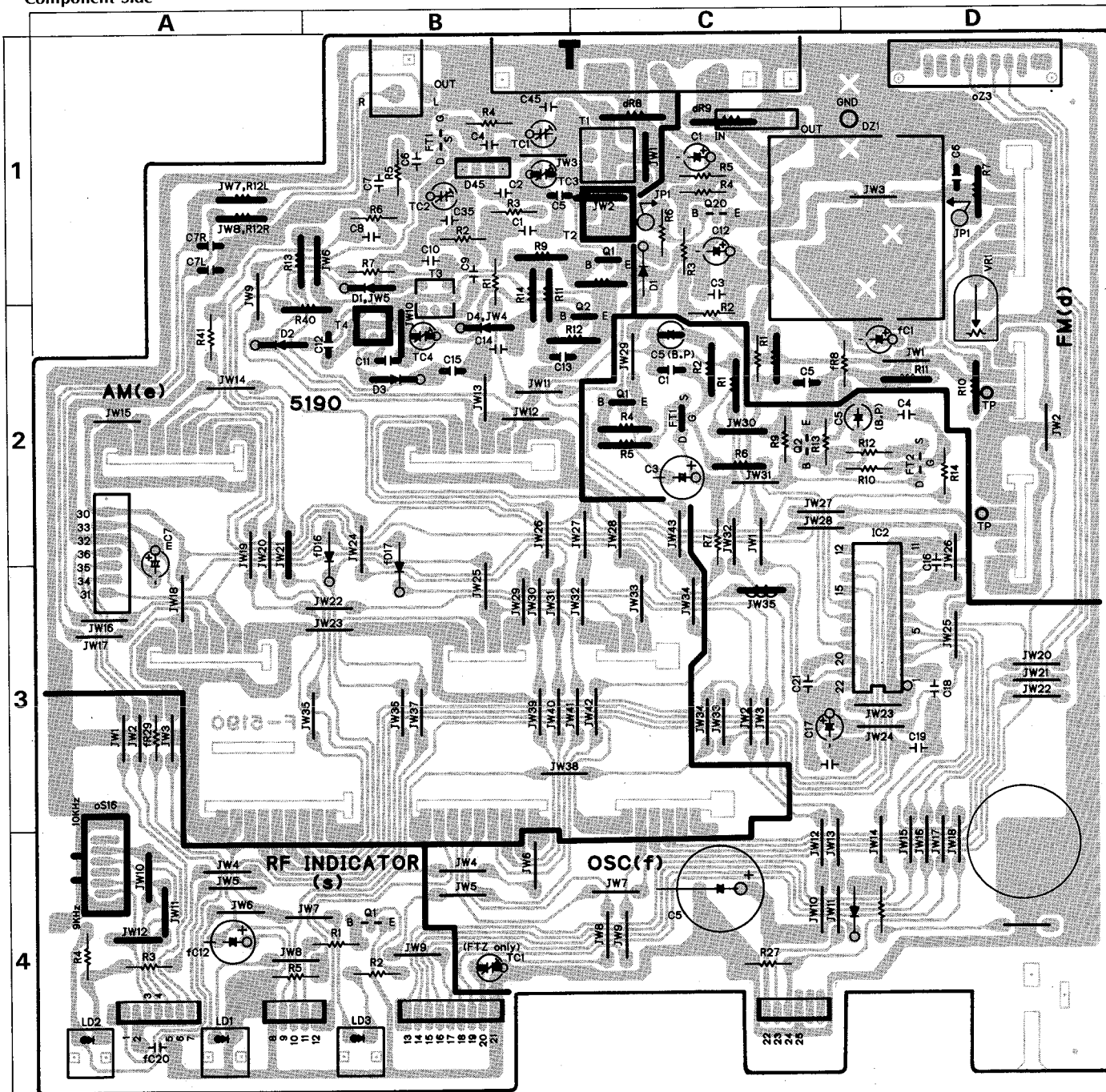
Parts No.	Stock No.	Description
•Transistor		
oQ1	46367101	2SC2603
	or 46367301	2SC2458
	or 46391901	2SC2785
oQ2	46391901	2SC2785 (T-E550L)
	or 46367101	2SC2603 (T-E550L)
	or 46367301	2SC2458 (T-E550L)
oQ3	46391901	2SC2785 (T-E550L)
	or 46367101	2SC2603 (T-E550L)
	or 46367301	2SC2458 (T-E550L)
oQ4	46367001	2SA1115
	or 46367201	2SA1048
	or 46392001	2SA1175
oQ5	46392001	2SA1175 (T-E550L)
	or 46367001	2SA1115 (T-E550L)
	or 46367201	2SA1048 (T-E550L)
oQ6	46367001	2SA1115
	or 46367201	2SA1048
	or 46392001	2SA1175
oQ7	46367101	2SC2603
	or 46367301	2SC2458
	or 46391901	2SC2785
oQ8	46367001	2SA1115
	or 46367201	2SA1048
	or 46392001	2SA1175
oQ9	46526900	2SD1111
oQ10	46367101	2SC2603
	or 46367301	2SC2458
	or 46391901	2SC2785
oQ11	46367001	2SA1115
	or 46367201	2SA1048
	or 46392001	2SA1175
oQ12	46367001	2SA1115
	or 46367201	2SA1048
	or 46392001	2SA1175
oQ13	46367101	2SC2603
	or 46367301	2SC2458
	or 46391901	2SC2785
oQ14	46367101	2SC2603
	or 46367301	2SC2458
	or 46391901	2SC2785
oQ15	46367001	2SA1115
	or 46367201	2SA1048
	or 46392001	2SA1175
•Diode		
oD1	46852000	RLS-73 (Chip) (T-E550L)
oD2	46852000	RLS-73 (Chip) (T-E550L)
oD3	46852000	RLS-73 (Chip)
oD4	46852000	RLS-73 (Chip)

Parts No.	Stock No.	Description
oD5	46852000	RLS-73 (Chip)
oD6	46852000	RLS-73 (Chip) (T-E550)
oD7	46852000	RLS-73 (Chip) (T-E550)
oJW1	46741100	Cross Conductor (Chip)
oJW3	46741100	Cross Conductor (Chip)
oJW4	46741100	Cross Conductor (Chip)
oJW5	46741100	Cross Conductor (Chip)
oJW6	46741100	Cross Conductor (Chip) (T-E550)
oJW7	46741100	Cross Conductor (Chip)
oJW8	46741100	Cross Conductor (Chip)
oJW9	46741100	Cross Conductor (Chip)
oJW10	46741100	Cross Conductor (Chip)
oJW11	46741100	Cross Conductor (Chip)
oJW12	46741100	Cross Conductor (Chip) (T-E550L)
oJW13	46741100	Cross Conductor (Chip) (T-E550L)
oR1	46750000	10kΩ 1/8W Chip R.
oR2	46750000	10kΩ 1/8W Chip R. (T-E550L)
oR3	46750000	10kΩ 1/8W Chip R. (T-E550L)
oR4	46750000	10kΩ 1/8W Chip R.
oR5	46750800	22kΩ 1/8W Chip R.
oR6	46750000	10kΩ 1/8W Chip R. (T-E550L)
oR7	46750800	22kΩ 1/8W Chip R. (T-E550L)
oR8	46750000	10kΩ 1/8W Chip R. (T-E550L)
oR9	46750800	22kΩ 1/8W Chip R.
oR10	46750800	22kΩ 1/8W Chip R. (T-E550)
oR11	46750400	15kΩ 1/8W Chip R.
oR12	46751600	47kΩ 1/8W Chip R.
oR13	46750000	10kΩ 1/8W Chip R.
oR14	46747000	560Ω 1/8W Chip R.
oR15	46748200	1.8kΩ 1/8W Chip R.
oR16	46749200	4.7kΩ 1/8W Chip R.
oR17	46749200	4.7kΩ 1/8W Chip R.
oR18	46750800	22kΩ 1/8W Chip R.
oR19	46750800	22kΩ 1/8W Chip R.
oR21	46754600	820kΩ 1/8W Chip R.
oR22	46749200	4.7kΩ 1/8W Chip R.
oR23	46749000	3.9kΩ 1/8W Chip R.
oR24	46747200	680Ω 1/8W Chip R.
oR25	46750000	10kΩ 1/8W Chip R.
oR26	46750000	10kΩ 1/8W Chip R.
oR27	46750000	10kΩ 1/8W Chip R.
oR28	46749200	4.7kΩ 1/8W Chip R.
oR29	46750000	10kΩ 1/8W Chip R.
oR30	46750000	10kΩ 1/8W Chip R.
oR31	46750000	10kΩ 1/8W Chip R.
oR32	46751600	47kΩ 1/8W Chip R.
oR33	46752400	100kΩ 1/8W Chip R. (T-E550)
oR34	46752400	100kΩ 1/8W Chip R.
oR35	46751000	27kΩ 1/8W Chip R.

### 3-5. F-5190 FM Frontend & PLL Synthesizer Board

(Stock No. 00954301 = T-E550-XX) (Stock No. 00954302 = T-E550-UL,CSA,AS)  
(Stock No. 00954304 = T-E550-SA) (Stock No. 00954305 = T-E550L)

Component Side



## Parts List

Parts No.	Stock No.	Description
dZ1	46562600	FM Frontend Pack (T-E550-XX,UL,CSA,AS, T-E550L)
	46562900	FM Frontend Pack (T-E550-SA)
•Transistor dQ20	46367101 or 46367301 or 46391901	2SC2603 2SC2458 2SC2785
•Diode dD1	03117600 or 46086000	1S2473T77 1S1588TP-3
dFL1	46183000	Band Filter (T-E550L)
ΔdR2	46229000	100Ω 1/2W N.I.R.
dVR1	10370700	10kΩ (B) S.V.R., Muting Adj.

Parts No.	Stock No.	Description
•Transistor eQ1 eQ2	46540801 46540801	2SC2878 (T-E550L) 2SC2878 (T-E550L)
•FET eFT1	46393000 or 46393001	2SK192A-Y 2SK192A-GR
•Diode eD1 eD2 eD3	03117600 or 46086000 03117600 or 46086000 03117600 or 46086000	1S2473T77 (T-E550L) 1S1588TP-3 (T-E550L) 1S2473T77 (T-E550L) 1S1588TP-3 (T-E550L) 1S2473T77 (T-E550L) 1S1588TP-3 (T-E550L)



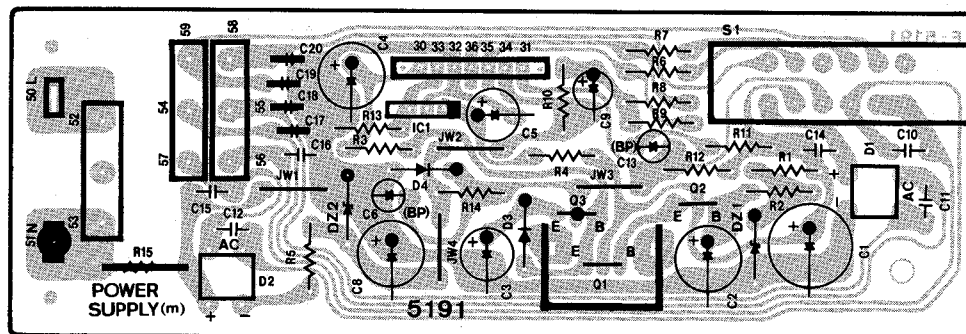
## Parts List &lt; F-5190 &gt;

Parts No.	Stock No.	Description
eD4	03117600 or 46086000	1S2473T77 (T-E550L) 1S1588TP-3 (T-E550L)
eD5	46146300	Variable Capacitance Diode KV1236Z2
△eR41	46229000	100Ω 1/2W N.I.R.
eTC1	46162800 or 46437400	Trimmer Capacitor 20pF Trimmer Capacitor 20pF
eTC2	46162800 or 46437400	Trimmer Capacitor 20pF Trimmer Capacitor 20pF
eTC3	46437400 or 46162800	Trimmer Capacitor 20pF (T-E550L) Trimmer Capacitor 20pF (T-E550L)
eTC4	46437400 or 46162800	Trimmer Capacitor 20pF (T-E550L) Trimmer Capacitor 20pF (T-E550L)
eT1	46394600	AM ANT Coil
eT2	46397900	LW RF Coil (T-E550L)
eT3	48074300	MW OSC Coil
eT4	48074400	LW OSC Coil (T-E550L)
•Transistor		
fQ1	46391901 or 46367101 or 46367301	2SC2785 (T-E550L) 2SC2603 (T-E550L) 2SC2458 (T-E550L)
fQ2	46367101 or 46367301 or 46391901	2SC2603 2SC2458 2SC2785
•FET		
fft1	46643601 or 46643602 or 46643501 or 46643502	2SK117-Y (T-E550L) 2SK117-GR (T-E550L) 2SK163-K2 (T-E550L) 2SK163-L1 (T-E550L)
fft2	46643501 or 46643502 or 46643601 or 46643602	2SK163-K2 2SK163-L1 2SK117-Y 2SK117-GR

Parts No.	Stock No.	Description
•IC		
fIC2	48161001	TC9182P-2
•Diode		
fD16	03117600 or 46086000	1S2473T77 1S1588TP-3
fD17	03117600 or 46086000	1S2473T77 1S1588TP-3
△fR7	46227800	10Ω 1/2W N.I.R.
△fR29	46228800	68Ω 1/2W N.I.R.
fC2	48103400	1μF 50V E.B. (T-E550L)
fC5	48103500	2.2μF 50V E.B.
fC15	48485800	4700μF 6.3V E.C.
fFL1	48484600	Filter
•Diode		
oD6	03117600 or 46086000	1S2473T77 (T-E550L) 1S1588TP-3 (T-E550L)
oD7	03117600 or 46086000	1S2473T77 (T-E550L) 1S1588TP-3 (T-E550L)
oS16	46177200	Slide SW., 9kHz/10kHz (T-E550-XX)
oZ3	48313900	ST Socket (10 Pin)
oZ1	46438100	2P Terminal, OUTPUT
oZ2	46547300 46410200	4P Terminal, ANTENNA (T-E550) 2P Terminal, ANTENNA (T-E550L)
•Transistor		
sQ1	46367101 or 46367301 or 46391901	2SC2603 2SC2458 2SC2785
•LED		
sLD1	48185200	GL-3NG87
sLD2	46176900	TLS-123
	or 46470200	SEL2210S
sLD3	48185200	GL-3NG87

## 3-6. F-5191 Power Supply Board (Stock No. 00954401 = T-E550-XX,UL,CSA) (Stock No. 00954405 = T-E550-SA,AS,T-E550L)

Component Side



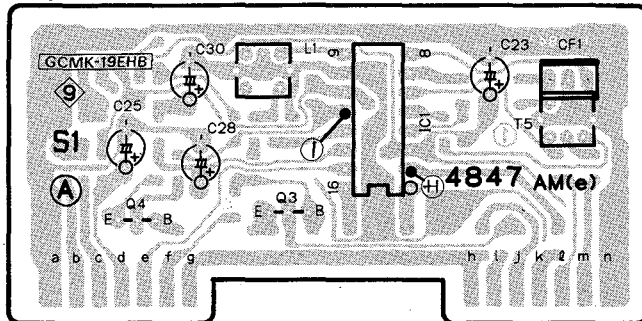
## Parts List

Parts No.	Stock No.	Description
•Transistor		
△mQ1	03083901	2SD313HP
△mQ2	or 46546701	2SD880
	46367101	2SC2603
	or 46367301	2SC2458
	or 46391901	2SC2785
mQ3	46367001	2SA1115
	or 46367201	2SA1048
	or 46392001	2SA1175
•IC		
△mIC1	46144300	NJM78M06A
	or 46361200	L78N06
•Diode		
△mD1	46273600	DBB10-B
	or 46273700	DBB10-C
	or 48192000	DBB10E
	or 48192100	DBB10G
△mD2	46273600	DBB10-B
	or 46273700	DBB10-C

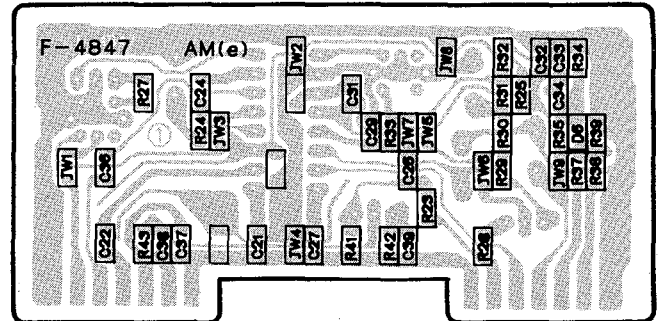
Parts No.	Stock No.	Description
△	or 48192000	DBB10E
△	or 48192100	DBB10G
mD3	03117600	1S2473T77
	or 46086000	1S1588TP-3
mD4	03117600 or 46086000	1S2473T77 1S1588TP-3
•Zener Diode		
mDZ1	46114300	05Z13-Z
mDZ2	46115700	05Z22-Y
△mR3	46227600	6.8Ω 1/2W N.I.R.
△mR4	46229000	100Ω 1/2W N.I.R.
△mR5	46229000	100Ω 1/2W N.I.R.
mC6	48103500	2.2μF 50V E.B.
mC13	48103400	1μF 50V E.B.
△mS1	48186800	Push SW., POWER (T-E550-SA,AS, T-E550L)
△	48186900	Push SW., POWER (T-E550-XX,UL,CSA)

### 3-7. F-4847 AM IF Amp. Board (Stock No. 00879001 = T-E550) (Stock No. 00879005 = T-E550L)

Component Side



Pattern Side &lt; Chip Parts &gt;



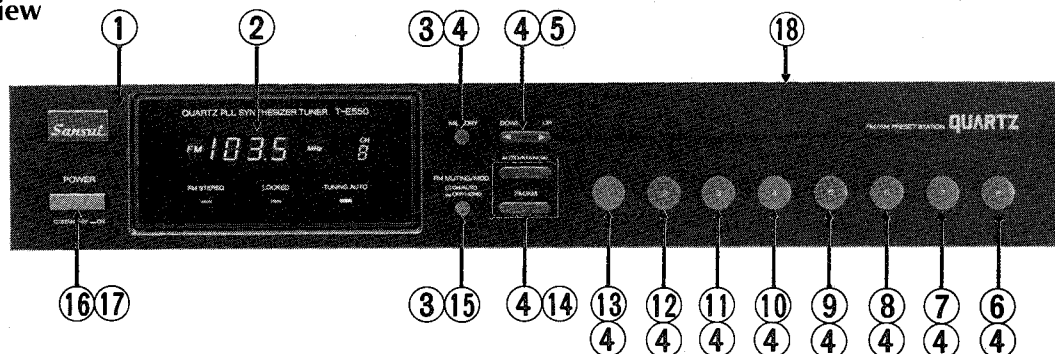
## Parts List

Parts No.	Stock No.	Description
•Transistor		
eQ3	46202901	2SC1674
eQ4	46367101	2SC2603
	or 46367301	2SC2458
	or 46391901	2SC2785
•IC		
eIC1	03608000	LA1240
•Diode		
eD6	46852000	RLS-73 (Chip)
eJW1	46741100	Cross Conductor (Chip)
eJW2	46741100	Cross Conductor (Chip)
eJW3	46741100	Cross Conductor (Chip)
eJW4	46741100	Cross Conductor (Chip)
eJW5	46741100	Cross Conductor (Chip)
eJW6	46741100	Cross Conductor (Chip)
eJW7	46741100	Cross Conductor (Chip)
eJW8	46741100	Cross Conductor (Chip)
eJW9	46741100	Cross Conductor (Chip)
eR23	46751600	47k $\Omega$ 1/8W Chip R.
eR24	46747600	1k $\Omega$ 1/8W Chip R.
eR25	46745200	100 $\Omega$ 1/8W Chip R.
eR27	46744400	47 $\Omega$ 1/8W Chip R.
eR28	46750800	22k $\Omega$ 1/8W Chip R.
eR29	46748400	2.2k $\Omega$ 1/8W Chip R.
eR30	46750000	10k $\Omega$ 1/8W Chip R.
eR31	46750000	10k $\Omega$ 1/8W Chip R.
eR32	46747600	1k $\Omega$ 1/8W Chip R.

Parts No.	Stock No.	Description
eR33	46745200	100 $\Omega$ 1/8W Chip R.
eR34	46752400	100k $\Omega$ 1/8W Chip R.
eR35	46751800	56k $\Omega$ 1/8W Chip R.
eR37	46751600	47k $\Omega$ 1/8W Chip R.
eR38	46754400	680k $\Omega$ 1/8W Chip R.
eR39	46753200	220k $\Omega$ 1/8W Chip R.
eR41	46750800	22k $\Omega$ 1/8W Chip R.
eR42	46750000	10k $\Omega$ 1/8W Chip R.
eR43	46749200	4.7k $\Omega$ 1/8W Chip R.
eC21	46794300	1000pF 50V Chip C.
eC22	46854500	22000pF 50V Chip C.
eC24	46854500	22000pF 50V Chip C.
eC26	46854500	22000pF 50V Chip C.
eC27	46854500	22000pF 50V Chip C.
eC29	46795500	10000pF 50V Chip C.
eC31	46795500	10000pF 50V Chip C.
eC32	46854900	47000pF 50V Chip C.
eC33	46794300	1000pF 50V Chip C.
eC34	46854900	47000pF 50V Chip C.
eC36	46795500	10000pF 50V Chip C.
eC37	46795500	10000pF 50V Chip C.
eC38	46854500	22000pF 50V Chip C.
eC39	46854900	47000pF 50V Chip C.
eCF1	48069900	Ceramic Filter (T-E550L)
eT5	48069800	Ceramic Filter CFLZ450 (T-E550)
	48072000	AM IF Coil (T-E550L)
eL1	46369600	AM IF Coil

## 4. OTHER PARTS

### 4-1. Front View

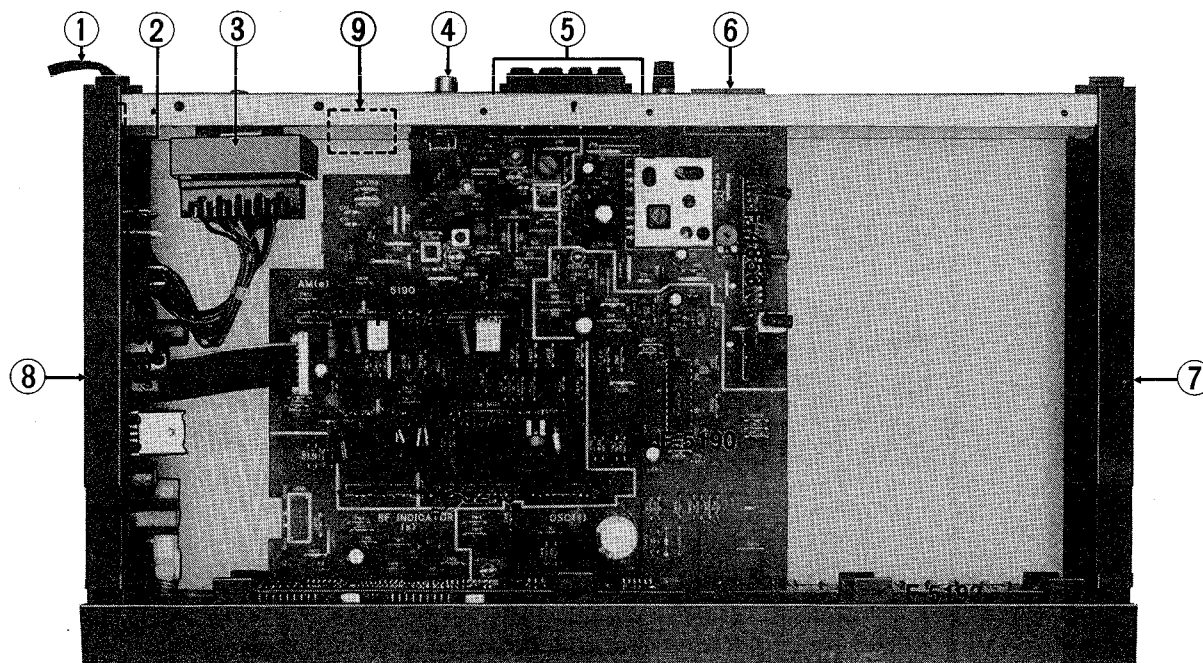


#### Parts List

Parts No.	Stock No.	Description
1	27106800	Front Panel Ass'y (T-E550)
	27106900	Front Panel Ass'y (T-E550L)
2	48314300	FL. Display
3	27038500	Knob, MEMORY, FM MUTING/MODE
4	46708100	Push SW., MEMORY, UP/DOWN, 1~8, AUTO/MANUAL, FM/AM
5	27048700	Knob, UP/DOWN
6	27108310	Knob, 8
7	27108200	Knob, 7
8	27108100	Knob, 6

Parts No.	Stock No.	Description
9	27108000	Knob, 5
10	27107900	Knob, 4
11	27107800	Knob, 3
12	27107700	Knob, 2
13	27107610	Knob, 1
14	27048600	Knob, AUTO/MANUAL, FM/AM
15	48313800	Push SW., FM MUTING/MODE
16	27039700	Knob, POWER
△ 17	48186800	Push SW., POWER
18	27049000	Bonnet

### 4-2. Top View



#### Parts List

Parts No.	Stock No.	Description
△ 1	38005400	Power Supply Cord (T-E550-XX, CSA, SA)
△	38004700	Power Supply Cord (T-E550-UL)
△	38004500	Power Supply Cord (T-E550L-EU)
△	38004300	Power Supply Cord (T-E550L-UK)
△	07204200	Power Supply Cord (T-E550-AS)
2	47157300	AC Cord Cover
△ 3	15024409	Power Transformer (T-E550-XX, SA)
△	15024402	Power Transformer (T-E550-UL, CSA)

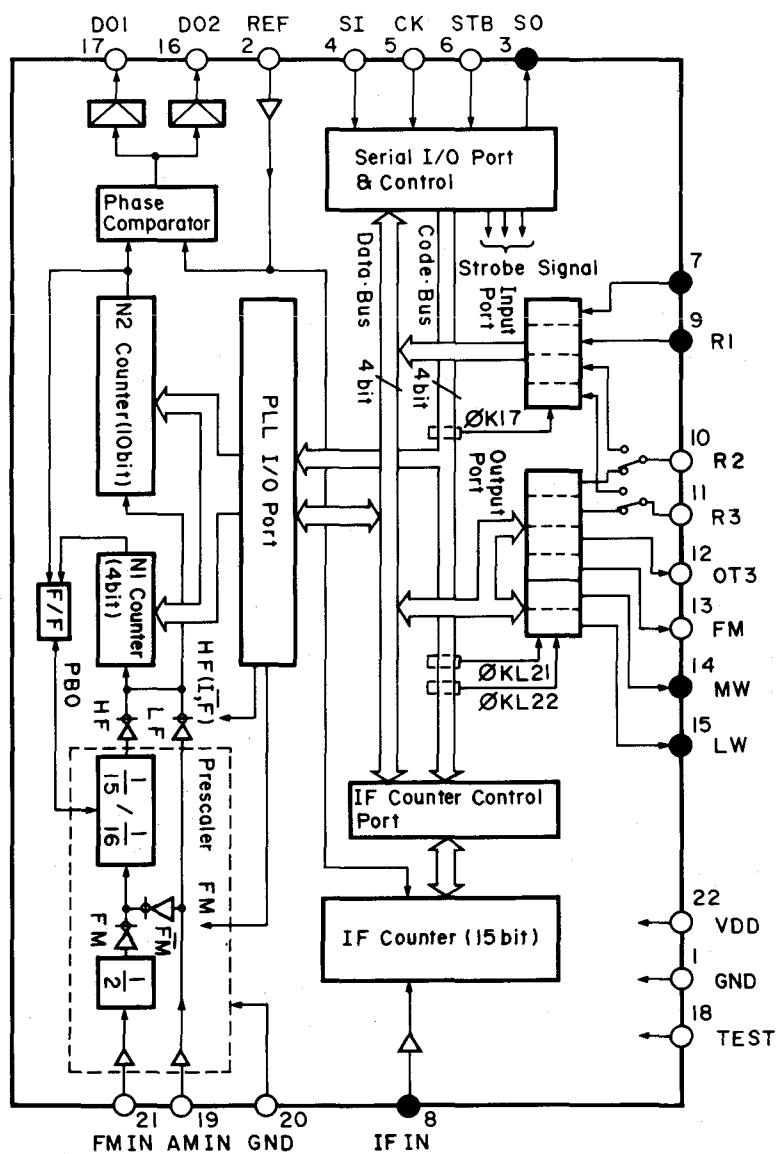
Parts No.	Stock No.	Description
△	15024405	Power Transformer (T-E550-AS, T-E550L)
4	46438100	2P Terminal, OUTPUT
5	46547300	4P Terminal, ANTENNA
6	48313900	10 Pin Socket, SYSTEM CONTROL
7	27106100	Right Side Panel Ass'y
8	27106200	Left Side Panel Ass'y
△ 9	07204700	Slide SW., VOLTAGE SELECTOR (T-E550L)
△	48175200	Plug, VOLTAGE SELECTOR (T-E550-XX)

## 5. DESCRIPTION OF PLL SYNTHESIZER & THE CONTROL IC

### A. Terminal Function of PLL Synthesizer IC, TC-9182P

Pin No.	Symbols on substate	Functions
2	REF	Reference frequency signal input terminal
3	SO	Serial data output terminal
4	SI	Serial data input terminal
5	CK	Clock signal input terminal
6	STB	Strobe signal input terminal
		•Terminals to input/output serial data for frequency divider, IF counter and I/O port controller from/to TC-9303N-002 PLL synthesizer control IC.
8	IF <sub>IN</sub>	Terminal to input IF signal for performing the automatic search stop.
9	R1	Terminals to input signals from the remote controller. 7-kind key input instructions are available in combination with TC-9303N-002.
10	R2	
11	R3	

Pin No.	Symbols on substate	Functions
13	FM	Band selector signal output terminal
14	MW	
15	LW	
16	DO <sub>2</sub>	Terminals to output a signal from a phase comparator.
17	DO <sub>1</sub>	
18	TEST	Terminal to input a signal of test mode.
19	AM <sub>IN</sub>	Terminal to input a signal from the AM local OSC.
20	GND	Ground terminal for prescaler
21	FM <sub>IN</sub>	Terminal to input a signal from the FM local OSC.
22	V <sub>DD</sub>	Power supply terminals. 5V ± 0.5V
1	GND	Ground terminal

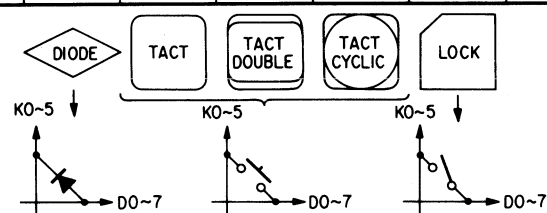


## B. Description of PLL Synthesizer control IC, TC-9303N-002

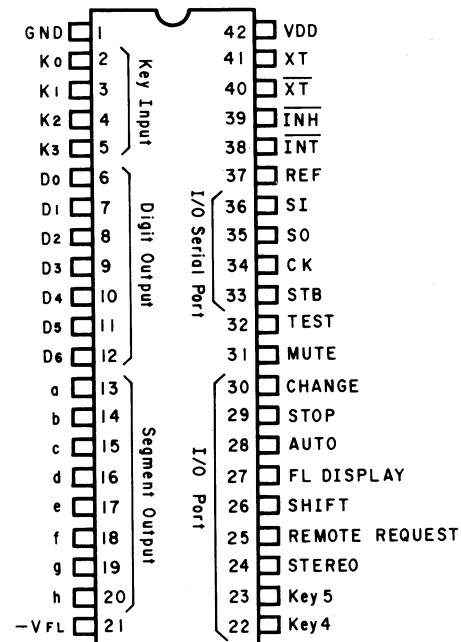
### 1. Various Key Matrix Functions

#### •Key Matrix

Key Input Terminal of TC9303N-002						
	K5	K4	K3	K2	K1	K0
D7	FM EI	FM EO		MANUAL		MEMORY
D6	MW EI	MW EO	MW/LW	UP	+10	+10
D4		LW EO	FM	DOWN	10	5
D3			MONO	FM MUTE-OFF	9	4
D2	LW ENA	RANDOM		MANUAL AUTO	8	3
D1	FMIF+50K	FMIF-50K		BAND	7	2
D0	20/10	12/6	MEMORY HOLD SCAN	MEMORY INCREMENT	6	1



#### •Chip Diagram



#### •Reception Range

	Desti-nation	KEY MATRIX		Reception	IF	Step (kHz)
		E <sub>0</sub>	E <sub>1</sub>			
F M	USA	0	0	87.5 ~ 108.0	+	100
	EU	1	0	87.50 ~ 108.00	+	50
	Japan	0	1	76.0 ~ 90.0	—	100
	SABS	1	1	87.50 ~ 108.00	—	50
M W	USA	0	0	530 ~ 1610		10
	EU	1	0	522 ~ 1611		9
	SAUDI	0	1	531 ~ 1602		9
	Japan	1	1	522 ~ 1629		9
L W		0	—	153 ~ 281		1
		1	—	153 ~ 360		1

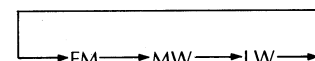
#### •FM IF Shift/Offset

- a) When SHIFT port is at "H" input, FM IF is always offset as shown by Table below.

KEY MATRIX		LOCAL UP	LOCAL LOW
-50kHz	+50kHz	USA, EU	Japan, SABS
—	—	10.70 MHz	10.70 MHz
○	—	10.65	10.75
—	○	10.75	10.65
○	○	10.70	10.70

#### •Band Selection

- a) When **FM** key is depressed in MW or LW, FM is set. When **FM** key is depressed in FM band, only CHANGE output is set to "H".
- b) In the absence of **LW ENA** diode:
- When **MW/LW** key is depressed in FM, MW is set. When **MW/LW** key is depressed in MW, only CHANGE output is set to "H".
  - When **BAND** key is depressed or when remote control BAND is requested, FM changes to MW or vice versa cyclically for each one-depression or for each request.
- c) In the presence of **LW ENA** diode:
- When **MW/LW** key is depressed in FM, FM changes to MW by the first depression, and thereafter LW changes to MW or vice versa cyclically for each depression.
  - When **BAND** key is depressed or when remote control BAND is requested, the reception band changes in sequence as shown below for each depression or for each request:



#### •Auto-Search Tuning

Tuning operation stops in case where a stop signal is detected in Auto-Search Tuning operated by depressing **UP** or **DOWN** key.

#### •Manual Tuning

- When **UP** or **DOWN** key is depressed, tuning advances one step for each depression (one step/one push).
- If the key is kept depressed for 0.5 seconds or more, one step/one push tuning changes to continuous tuning. However, when the key is released, the tuning operation stops.
- When tuning reaches one band edge, the tuning operation jumps to another band edge. After a stop interval of 5 seconds, tuning returns to one step/one push tuning or continuous tuning.

#### •Preset Memory

- b) Access to Preset Memory

Preset memory can be accessed by depressing any one of **M1** to **M10** keys or **Mn** and **+10** keys simultaneously.

**Note** Accessable by depressing either or both of **+10** keys (D<sub>6</sub>-K<sub>0</sub>, D<sub>6</sub>-K<sub>1</sub>).

- d) Writing

When **MEMORY** key is kept depressed, **MEMORY** and **CH** indications blink at 0.5-sec intervals.

When **Mn** key is depressed simultaneously with **MEMORY** key kept depressed, the present frequency is written in the memory, **MEMORY** indication going off and **CH** indication coming on.

#### •Memory Hold Scanning

Broadcast is received in order while reading data stored in each preset memory 5 seconds by seconds.

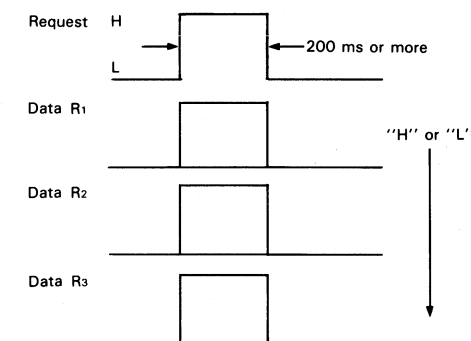
#### •Memory Increment

Broadcast is received while reading data stored in each preset memory in sequence.

### 2. I/O Port Functions

#### •Remote Control Input

- Main function  
7-kind key input instructions are available in combination with TC 9182.
- Input Port  
Remote Control Request input port of TC-9303N and Data R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub> input port of TC-9182P.
- Input signals



These request signals are always monitored. All the key input instructions are inhibited when a request signal is at "H". Remote control instructions have priority over others.

A continuous signal is usable for manual up/down tuning operation.

4. Functions

Input Port			Function	
R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>		
1	1	1	NOP	Only CHANGE Output
1	1	0	BAND	
0	1	0	MEMORY INCREMENT	
0	0	1	MONO ↔ STEREO	Cyclic
1	0	1	MUTE OFF ↔ ON	Cyclic
0	1	1	DOWN	Continuous
0	0	0	UP	Continuous
1	0	0	MANUAL ↔ AUTO	Cyclic

- (a) NOP is an input function for designating tuners and outputs only a CHANGE output.

- (b) The other functions are the same as these of TACT input key.

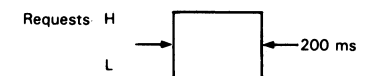
#### •Mute Output

System Mute Time

- When INH changes from "L" to "H": 1.5 sec
- When band is switched: 1.0 sec
- When memory is accessed (in the same band): 0.5 ~ 1 sec
- In FM MANUAL tuning: 0.5 sec
- In MW, LW MANUAL tuning: 0.2 sec
- In AUTO-Tuning Stop: 0.5 sec
- When INH changes from "H" to "L": 0.1 sec

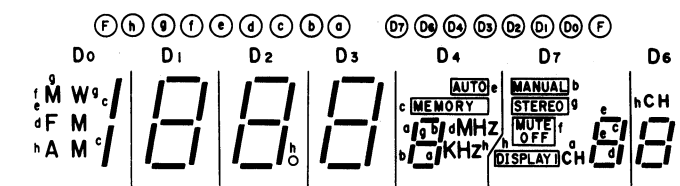
#### •CHANGE Output (For Compuselector signal)

- When INH changes from "L" to "H".
- When each input key is depressed normally.
- When a band key corresponding to the presently received band is depressed.
- When remote control REQUEST changes to "H" (inclusive of NOP).



**Note** CHANGE is not outputted when INH changes from "H" to "L".

#### •Indication by Digits and Segments



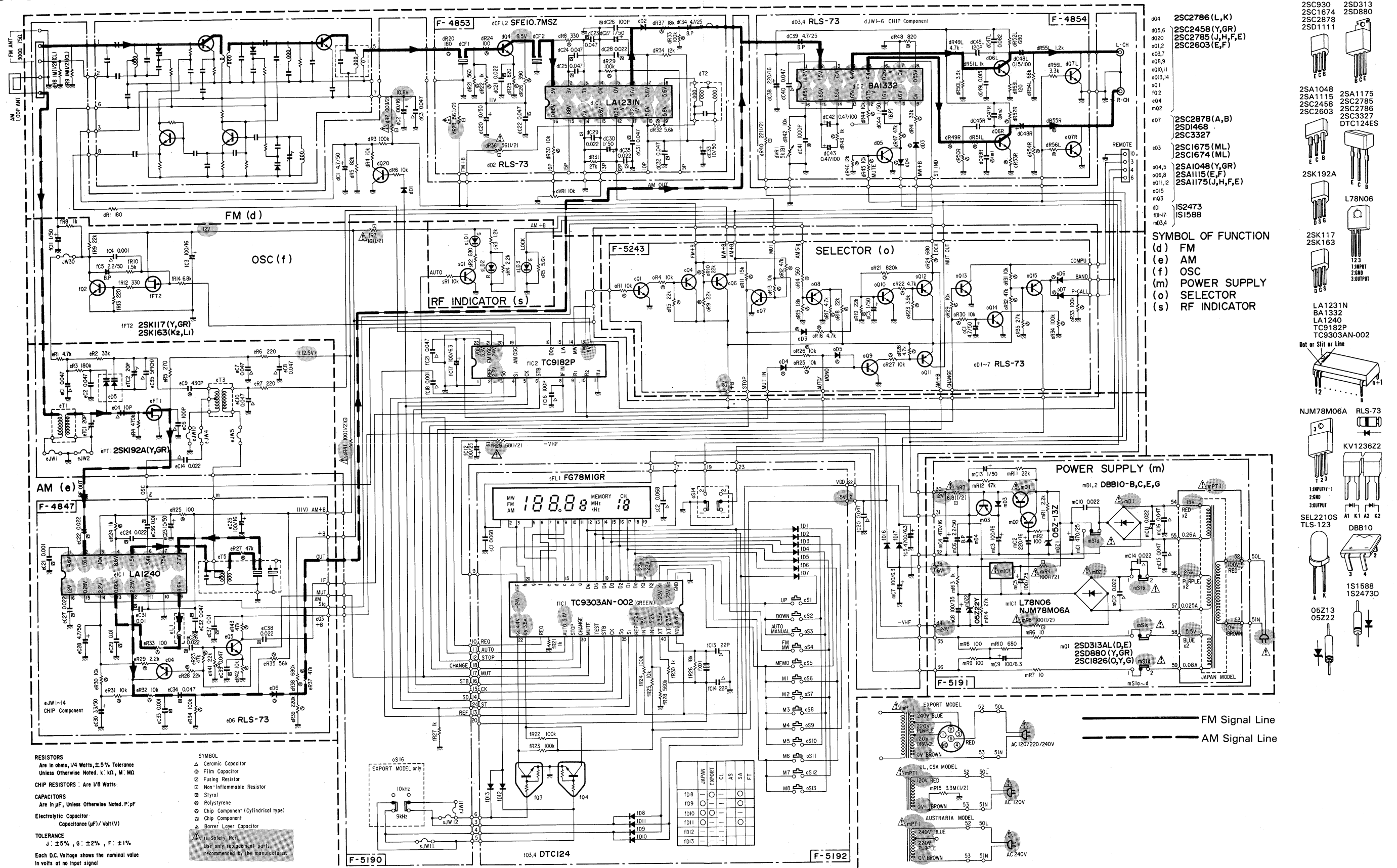
Digit Output						
	D <sub>0</sub>	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	D <sub>5</sub>
a	—	a	a	a	5	CH
b	—	b	b	b	8	MANUAL
c	8	c	c	c	MEMORY	c
d	FM	d	d	d	MHz	d
e	MW	e	e	e	AUTO	e
f	MW	f	f	f	MUTE OFF	f
g	MW	g	g	g	STEREO	g
h	AM		●		kHz	CH



## 6. SCHEMATIC DIAGRAM

## 6-1. T-E550

- \* Design and specifications subject to change without notice for improvement.
- \* La présentation et les spécifications sont susceptibles d'être modifiées sans préavis par suites d'améliorations éventuelles.
- \* Änderungen, die dem technischen Fortschritt dienen, bleiben vorbehalten.



## 6-2. T-E550L

Design and specifications subject to change without notice for improvement.  
La présentation et les spécifications sont susceptibles d'être modifiées sans préavis par suites d'améliorations éventuelles.  
Änderungen, die dem technischen Fortschritt dienen, bleiben vorbehalten.

SYMBOL OF  
FUNCTION  
(d) FM  
(e) AM  
(f) OSC  
(m) POWER  
(o) SELECTOR  
(s) RF INDICATOR

2SC930  
2SC1674  
2SC2878  
2SD1111

2SD313  
2SD880

2SA1048  
2SA1175  
2SC2458  
2SC2785  
2SC2803  
DTC124ES

2SK192A

L78N06

2SK117  
2SK163

1A1231N  
BA1332  
LA1240  
TC9182P  
TC9303AN-002

Del or Slt or Line

NJM78M06A

1S1588  
1S2473D

05Z13  
05Z22

SEL2210S  
TLS-123

DBB10

1S1588  
1S2473D

05Z13  
05Z22

SEL2210S  
TLS-123

DBB10

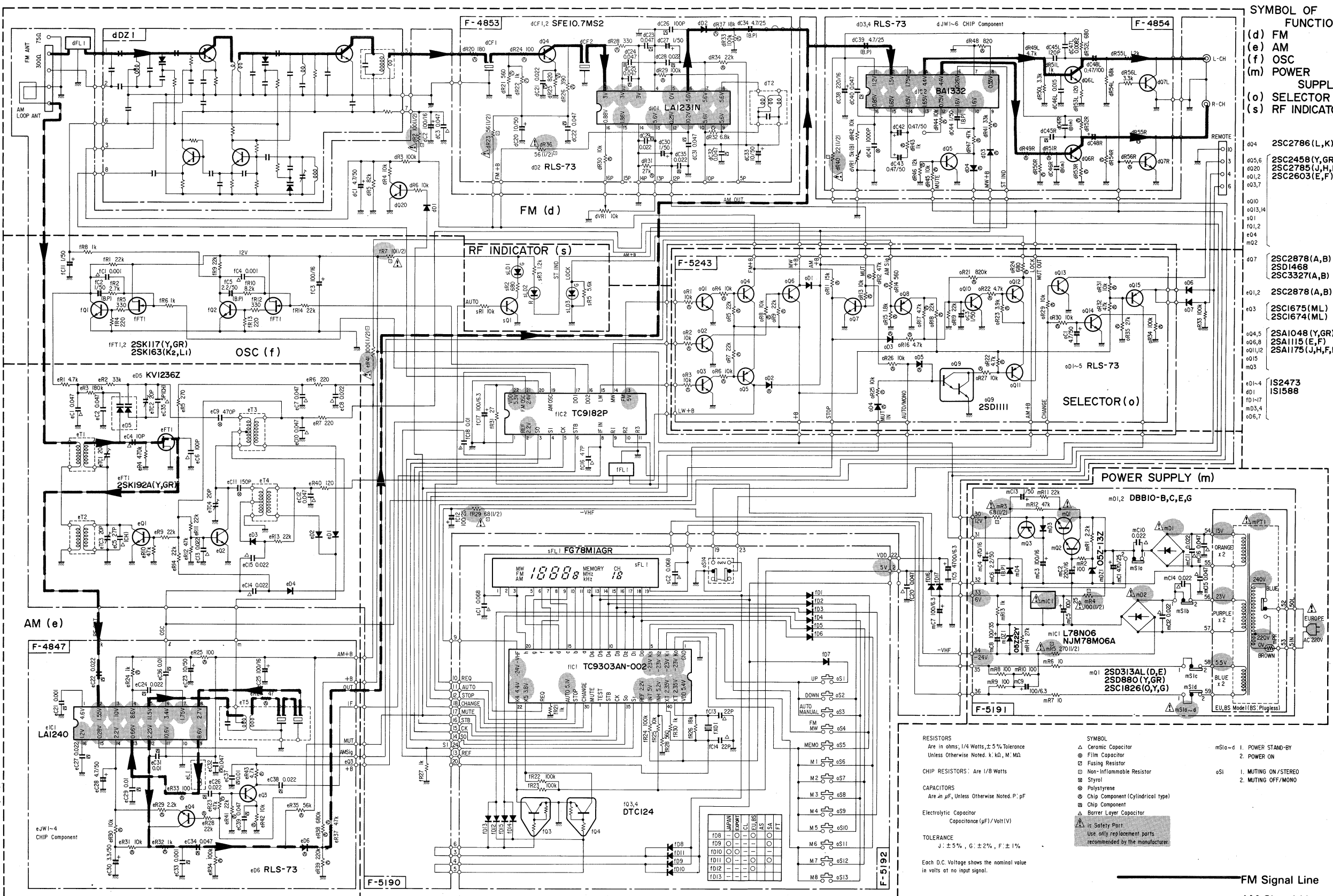
1S1588  
1S2473D

05Z13  
05Z22

SEL2210S  
TLS-123

DBB10

1S1588  
1S2473D



RESISTORS  
Are in ohms, 1/4 Watts,  $\pm 5\%$  Tolerance  
Unless Otherwise Noted. K: k $\Omega$ , M: M $\Omega$

CHIP RESISTORS: Are 1/8 Watts

CAPACITORS  
Are in  $\mu$ F, Unless Otherwise Noted. P: pF

Electrolytic Capacitor  
Capacitance ( $\mu$ F)/Volt (V)

TOLERANCE  
J:  $\pm 5\%$ , G:  $\pm 2\%$ , F:  $\pm 1\%$

Each D.C. Voltage shows the nominal value  
in volts at no input signal.

SYMBOL  
△ Ceramic Capacitor  
□ Film Capacitor  
□ Fusing Resistor  
□ Non-Inflammable Resistor  
□ Styrol  
□ Polystyrene  
□ Chip Component (Cylindrical type)  
□ Chip Component  
□ Barrier Layer Capacitor  
△ is Safety Part.  
Use only replacement parts  
recommended by the manufacturer.

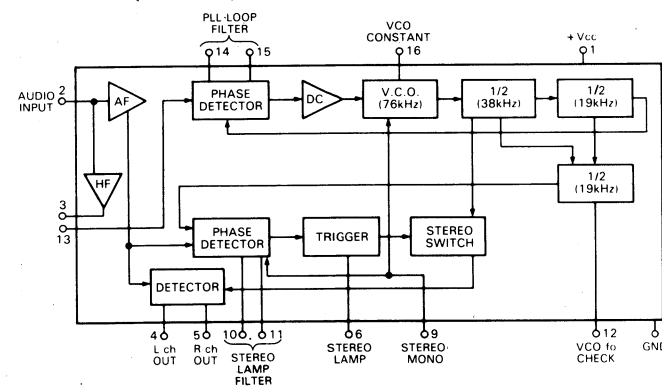
mSio-d 1. POWER STAND-BY  
2. POWER ON  
oSI 1. MUTING ON/STEREO  
2. MUTING OFF/MONO

FM Signal Line  
AM Signal Line

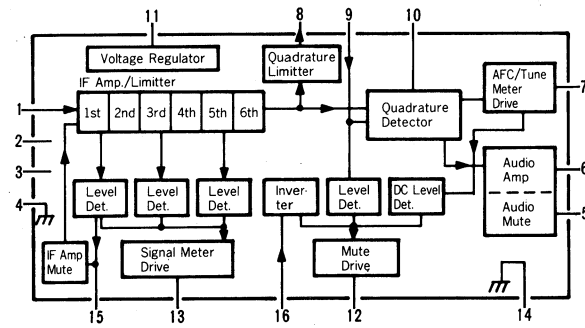


## 7. INTERIOR BLOCK DIAGRAM OF IC

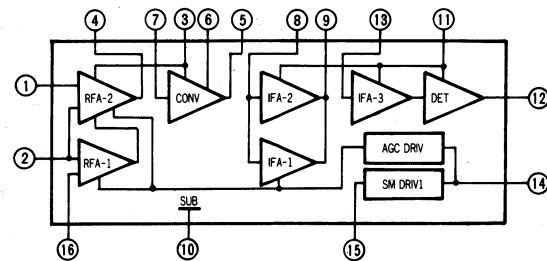
### •BA1332 (MPX IC)



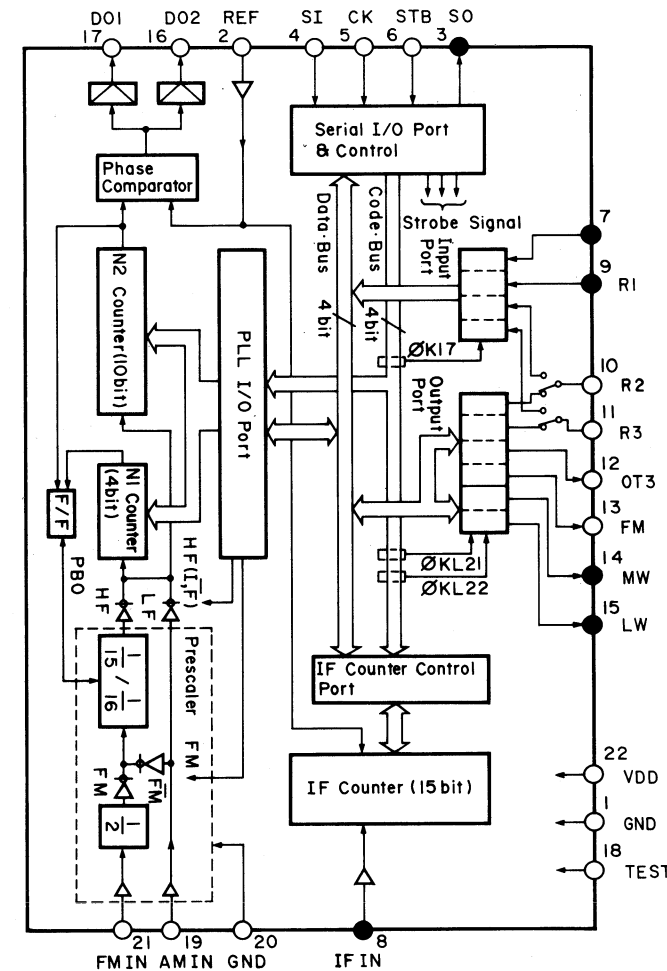
### •LA1231N (IF & Quadrature Detector IC)



### •LA1240 (AM Tuner IC)

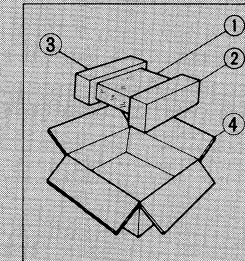


### •TC-9182P (PLL Synthesizer IC)



## 9. PACKING LIST

Parts No.	Stock No.	Description
1	27139800	Vinyl Bag
2	27123500	Styrofoam Packing (R)
3	27123400	Styrofoam Packing (L)
4	27051100	Carton Case (T-E550)
	27051200	Carton Case (T-E550L)



## 10. ACCESSORY LIST

Stock No.	Description
46145700	AM Loop Antenna
48489800	Matching Transformer (T-E550L)
46051700	FM Antenna
38103200	Pin Plug Cord
07563000	Antenna Holder
27105900	Player Stand Ass'y (R)
27106000	Player Stand Ass'y (L)
46995900	Operating Instruction (*E•F•S)
46996000	Operating Instruction (*G•I•Sw)

### \*Note:

E•F•S: English•French and Spanish Version  
G•I•Sw: German•Italian and Swedish Version

## 8. NOTES

When the user moves to different channel step area on FM or AM, the following arrangements must be performed.

	Sets Applicable to	Channel Step Frequency		Parts (F-5192)					9k/10k Switch oS16
		AM	FM	fD8	fD9	fD10	fD11	fD12	
I	Europe	9kHz	50kHz	○	—	—	○	○	None
	America	10kHz	100kHz	—	—	—	—	—	None
	South Africa	9kHz	50kHz	○	○	—	○	—	None
II	Sets which 9k/10k Switch is installed	9kHz	50kHz	○	—	○	—	—	9 kHz
		10kHz	100kHz	○	—	○	—	—	10 kHz

\*Note: 1) ○ = Connect, — = Remove  
2) oS16 = AM 9k/10k Switch on F-5190

**Sansui**

SANSUI ELECTRIC CO., LTD.  
SANSUI ELECTRONICS CORPORATION  
SANSUI ELECTRONICS (U.K.) LTD.  
SANSUI ELECTRONICS G.M.B.H.

14-1, Izumi 2-chome, Suganami-ku, Tokyo 168 Japan  
PHONE: (03) 324-8891/TELEX: 232-2076 (International Division)  
1250 Valley Brook Ave. Lyndhurst, N.J. 07071 U.S.A.  
17150 South Margay Ave. Carson, California 90746 U.S.A.  
3036 Koapaka Street, Honolulu, Hawaii 96819 U.S.A.  
Unit 10A, Lyon Industrial Estate, Rockware Avenue, Greenford, Middx UB6, OAA, England  
Pau Ehrich Strasse 8, 6074 Rodermark 2, West Germany

(SM1-295)

Printed in Japan (264420M) <Stock No. 36522500>